FACTORS INFLUENCING THE USAGE OF MULTIMEDIA FOR TEACHING AMONGST HEALTH SCIENCES LECTURERS IN MALAYSIAN PUBLIC UNIVERSITIES: TOWARDS THE DEVELOPMENT OF A MULTIMEDIA REPOSITORY SYSTEM

by

ZAR NI WYNN

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DECLARATION

I declare that the contents presented in this thesis are my own work which was done at Universiti Sains Malaysia, unless stated otherwise. The thesis has not been previously submitted for any other degree.

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LIST OF SYMBOLS

α	alpha
β	beta
λ	lamda
σ	sigma

LIST OF ABBREVIATIONS

3D	Three-dimensional
A	Attitude
ACR	Awareness of Copyright issues
AGFI	Adjusted Goodness-of-Fit Index
AK	Awareness Knowledge
AMIT	Attitude toward Multimedia Integrated Teaching
AMOS	Analysis of Moment Structure
ANOVA	Analysis of Variance
AR	Alternative Resources
ASDM	Attitude towards Sharing Digital Materials
ATU	Attitude Towards Usage
AU	Actual System Use
BBS	Bulletin Board Systems
BI	Behavioural Intention to use
CBT	Case-Based Teaching
CC	Creative Common
CCLF	Creative Common License Framework
CDPA	Copyright, Designs and Patents Act
CFI	Comparative Fit Index
CI	Confidence Interval
CMS	Content Management System
COM	Compatibility
Com_Exp	Computer Experience
COM_INT	Combined Computer and Internet Use

COMP	Computer
CR	Critical Ratio
CSS	Cascading Style Sheets
CT	Computerized Tomography
CTR	Computer Technology Research
DCMI	Dublin Core Metadata Initiative
DF	Degree of Freedom
DISS	*Tesis USM*
DM	Digital Materials
DOI	Diffusion of Innovations
DRI	Digital Repository Interoperability
DRS	Digital Repository System
EQS	Structural Equation Modelling Software
FAQ	Frequently Asked Questions
FIPMT	Factor Influencing the Practice of Multimedia for Teaching
GFI	Goodness-of-Fit Index
GLM	General Linear Model
HEAL	Health Education Assets Library
HS	Health Sciences
HUSM	Hospital *Universiti Sains* Malaysia
ICTs	Information and Communication Technologies
IDT	Innovations Diffusion Theory
IEEE LOM	IEEE Learning Object Metadata
IEEE	Institute of Electric and Electronic Engineers
IFI	Incremental Fit Index
IIUM	International Islamic University

IMS	Instructional Management System
INFORMM	Institute for Research in Molecular Medicine
INT	Internet
IS	Information System(s)
ISO	International Organization for Standardization
IT	Information Technology
ITC	Item Total Correlation
ITU	International Telecommunication Union
IU	Intention to Use
K	Knowledge
KAP	Knowledge Attitude Practice
KMO	Kaiser-Meyer-Olkin
KUSTEM	University College of Science and Technology Malaysia
LIB	Library
LISREL	Linear structural relations
LMS	Learning Management System
LOM	Learning Object Metadata
LSTC	Learning Technology Standards Committee
Max	Maximum
MBIB	*Bibliografi Malaysia*
MCQ	Multiple Choice Question
MERLOT	Multimedia Education Repository for Learning and On-line Teaching
Min	Minimum
MIT	Multimedia Integrated Teaching
MLE	Maximum Likelihood Estimation
MLR	Multiple Linear Regression

MRI	Magnetic Resonance Imaging
MRS	Multimedia Repository System
MT	Multimedia Technology
MySQL	Structured Query Language
NFI	Normalized Fit Index
NTUCM	National Taiwan University College of Medicine
OAI-MHP	Open Archive Initiative for Metadata Harvesting Protocol
OS	Organizational Support
P	Practice
P2P	Peer to peer
PBL	Problem-Based Learning
PCA	Principal Component Analysis
PDA	Personal Digital Assistant
PEU	Perceived Ease of Use
PHP	PHP Hypertext Preprocessor
PLS	PLS Path Modelling Software
PPKT	*Pusat Pengetahuan Komunikasi and Teknologi* (Centre for Knowledge, Communication and Technology)
PPSG	*Pusat Pengajaan Sains Pergigian* (School of Dental Sciences)
PPSK	*Pusat Pengajaan Sains Kesihatan* (School of Health Sciences)
PPSP	*Pusat Pengajaan Sains Perubatan* (School of Medical Sciences)
PTF	Perceived Teaching Facilities
PTM	Perceived Teaching Materials
PTS	Perceived Teaching Strategies
PU	Perceived Usefulness
PUHS	Public Universities offering Health Sciences programmes

RDBMS	Relational Database Management System
R&D	Research and Development
RMSEA	Root Mean Square Error of Approximation
RMSR	Root Mean Square Residual
RQ	Research Question
SC 36	Sub Committee 36
SCORM	Sharable Content Object Reference Model
SD	Standard Deviation
SE	Standard Error
SEK	Standard Error of Kurtosis
SEM	Structural Equation Modelling
SES	Standard Error of Skewness
SLDF	Smart Learning Design Framework Project
SOFSYS	Soft System (combined software use, alternative resources use and sharing digital materials on peer to peer)
SHDM	Sharing Digital Materials
SPSS	Statistical Package for the Social Sciences
SWHW	Software and Hardware
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
TBP	Theory of Planned Behaviour
TK	Technological Knowledge
TRA	Theory of Reasoned Action
TS	Technical Support
UAE	United Arab Emirates
UCLA	University Of California at Los Angeles

UIK	*Unit Informatik Kesihatan* (Health Informatics Unit)
UiTM	Universiti Teknologi Mara
UK	United Kingdom
UKM	Universiti Kebangsaan Malaysia
UM	University of Malaya
UMS	Universiti Malaysia Sabah
UNIFESP	The Federal University of Sao Paulo
UNIMAS	Universiti Malaysia Sarawak
UPM	Universiti Putra Malaysia
UPSI	Universiti Pendidikan Sultan Idris
US, USA	United States of America
USM	Universiti Sains Malaysia
USM KK	*USM Kampus Kesihatan* (USM Health Campus)
UTAUT	Unified Theory of Acceptance and Use of Technology
VOD	Video On Demand
VSL	Virtual Subject Libraries
WE	Web Experience
Web-SAM	Web-based System Acceptance Model
WKEX	Working Experience
WWW	World Wide Web
XML	eXtensible Mark-up Language

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FAKTOR-FAKTOR YANG MEMPENGARUHI PENGGUNAAN MULTIMEDIA UNTUK PENGAJARAN DALAM KALANGAN PENSYARAH SAINS KESIHATAN DI UNIVERSITI AWAM MALAYSIA: KEARAH PEMBANGUNAN SISTEM PENYIMPANAN MULTIMEDIA

ABSTRAK

Penyepaduan multimedia untuk pengajaran sains perubatan dan sains kesihatan (SK) adalah terhad disebabkan faktor-faktor organisasi dan individu. Faktor-faktor organisasi yang telah dikenalpasti ialah kekurangan sokongan organisasi dalam penyediaan sumber, kemudahan, program latihan teknologi maklumat (IT) dan sokongan teknikal (TS). Faktor-faktor individu termasuklah sikap dan pengetahuan ahli akademik mengenai penyepaduan teknologi dalam pengajaran. Kajian ini dijalankan untuk meninjau status semasa tentang penggunaan multimedia dalam kalangan pensyarah SK di universiti awam Malaysia; untuk membuat kajian penilaian situasi bagi mengkaji tentang sokongan organisasi kepada pensyarah SK; dan untuk mereka bentuk, membangun dan menilai penerimaan pensyarah SK terhadap Sistem Penyimpanan Multimedia (*Multimedia Repository System – MRS*). Kajian ini dilaksanakan dalam dua fasa. Fasa I mengandungi dua subkajian iaitu kajian keratan lintang dan kajian penilaian situasi. Kajian keratan lintang telah dijalankan daripada bulan Januari sehingga Ogos 2006, dalam kalangan pensyarah SK daripada 10 universiti awam Malaysia. Borang soal-selidik versi Bahasa Inggeris yang telah disahkan, dihantar kepada 190 peserta dan 90% memberi maklumbalas. Ujian Mann Whitney, Kruskal-Wallis dan analisis regresi linear pelbagai dibuat menggunakan SPSS versi 15. Kajian penilaian situasi mengkaji persepsi penyedia latihan dan bengkel, dan juga sokongan organisasi di Kampus Kesihatan Universiti Sains Malaysia (USM KK). Lanjutan daripada itu, dalam Fasa II, sebuah MRS telah dibangun dengan mematuhi standard skema metadata Health Education Assets Library (HEAL). Pada bulan Januari 2008, satu Bengkel Penilaian Pengguna telah dijalankan dengan penyertaan 35 orang pensyarah SK di Pusat Pengajian Sains Kesihatan, USM KK. Di penghujung bengkel, peserta telah diberikan borang

soal-selidik versi Bahasa Inggeris untuk menilai persepsi mereka tentang MRS. Data yang dikumpul telah dibuat analisis laluan Structural Equation Modeling (SEM) menggunakan AMOS 7. Sebuah Model Penerimaaan Sistem Berasaskan Web (*Web-based System Acceptance Model - Web-SAM*) telah dibangunkan untuk menguji penerimaan MRS mempunyai 6 penentu untuk meramal niat untuk guna (IU), persepsi tentang mudah guna (PEU), persepsi tentang kebergunaan (PU); pengalaman web (WE), sokongan teknikal (TS); pengalaman komputer (Com_Exp); dan keserasian (COM). Keputusan menunjukkan walaupun penggunaan teknologi komputer dan Internet adalah tinggi, tetapi penggunaan perkakasan dan bahan perpustakaan hanya sederhana, manakala penggunaan perisian, simpanan digital dan perkongsian bahan digital adalah rendah. Amalan mereka adalah berkaitan secara signifikan dengan pengetahuan teknikal ($R^2 = 0.34$, F (df1, df2) = 79,46, $p < 0.0001$), sikap kepada perkongsian bahan digital melalui Internet ($R^2 = 0.40$, F (df1, df2) = 51,44, $p < 0.0001$), pengalaman bekerja mereka ($R^2 = 0.43$, F (df1, df2) = 37,44, $p < 0.0001$) dan persepsi terhadap bantuan bahan pengajaran di organisasi ($R^2 = 0.44$, F (df1, df2) = 30,06, $p < 0.0001$), serta kemudahan untuk pengajaran ($R^2 = 0.45$, F (df1, df2) = 24,95, $p < 0.0001$). Penemuan daripada kajian penilaian situasi menunjukkan kekurangan program latihan dan bengkel IT kepada pensyarah SK yang dapat menyokong amalan mereka untuk menggunakan multimedia dalam pengajaran. Kajian juga mendapati mereka memerlukan sistem penyimpanan untuk menyokong perkongsian bahan pengajaran multimedia digital. Keputusan daripada kajian penerimaan MRS menunjukkan bahawa PU ($\beta = 0.68$, $p<0.01$), COM ($\beta = 0.41$, $p<0.05$) dan Com_Exp ($\beta = 0.15$, $p<0.01$) adalah penentu langsung kepada IU MRS bagi penyediaan kuliah. TS memberi pengaruh langsung yang signifikan terhadap COM ($\beta = 0.71$, $p<0.01$) dan COM memberi pengaruh langsung yang signifikan terhadap PU ($\beta = 0.43$, $p<0.01$). Model Web-SAM menyumbang kepada 59% varians yang ditafsirkan atas IU. Apabila diuji terhadap Model Penerimaan Teknologi (TAM) Davis yang asal, dengan dua penentu – PEU dan PU – perbezaan yang ditunjukkan oleh IU hanyalah 45%. Peratusan lebih tinggi yang ditunjukkan oleh model Web-SAM membuktikan bahawa

model ini lebih teguh daripada TAM yang asal. Pada masa hadapan, kajian ini boleh diulang dalam bidang yang lain dan model Web-SAM yang dicadangkan ini berguna untuk menilai penerimaan sistem berasaskan web yang lain. MRS boleh ditambah baik dengan memasukkan lebih banyak ciri dan fungsi untuk menyokong keperluan pensyarah.

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ABSTRACT

In higher institutions worldwide, the integration of multimedia for teaching medical and health sciences (HS) has been limited owing to organizational and individual factors. Organizational factors identified were insufficient organizational support in terms of teaching resources, facilities, information technology training programmes and technical support. Individual factors include attitude and knowledge of academics on technology integration into their lectures. This study was conducted to explore the current status of multimedia usage among HS lecturers in Malaysian public universities; to conduct a situational assessment study to observe the current system of organization support for HS lecturers; and to design, implement and evaluate the acceptance of a new Multimedia Repository System (MRS). This study was conducted in two phases. Phase I consisted of two substudies; an exploratory study and a situational assessment study. For the exploratory study, a cross-sectional survey was conducted from January to August 2006, among the HS lecturers from 10 Malaysian public universities. An English version of a validated questionnaire was sent to 190 participants and 90% responded. The Mann Whitney test, Kruskal-Wallis test and multiple linear regression analysis were carried out using SPSS version 15. The situational assessment study investigated the perceptions of training and workshop organizers, as well as the organization support in the Universiti Sains Malaysia Health Campus (USM KK). Consequently, in Phase II of the study, a new MRS was developed in conformance with Health Education Assets Library (HEAL) metadata schema standard. In January 2008, a User Evaluation Workshop was conducted among 35 HS lecturers in the School of Health Sciences (PPSK), USM KK. An English version of the validated questionnaire was given to participants at the end of the hands-on section. Structural Equation Modeling (SEM)

was used for the path analysis using AMOS 7. A Web-based System Acceptance Model (Web-SAM) was developed to test MRS acceptance which consisted of 6 determinants to predict the intention to use (IU) of MRS in the future: perceived ease of use (PEU); perceived usefulness (PU); Web experience (WE); technical support (TS); computer experience (Com_Exp); and compatibility (COM). Results show that, although HS lecturers' technology usage was high on computer and Internet, their use was just above average on hardware and library materials, and low on software, digital repositories and sharing digital materials (DM) among them. Their practice was significantly associated with their technological knowledge ($R^2 = 0.34$, F (df1, df2) = 79,46, $p < 0.0001$), their attitudes towards sharing DM via the Internet ($R^2 = 0.40$, F (df1, df2) = 51,44, $p < 0.0001$), their working experience ($R^2 = 0.43$, F (df1, df2) = 37,44, $p < 0.0001$), their perceived organizational support on teaching materials ($R^2 = 0.44$, F (df1, df2) = 30,06, $p < 0.0001$), and teaching facilities ($R^2 = 0.45$, F (df1, df2) = 24,95, $p < 0.0001$). The findings from the situational assessment study indicated that USM KK was lacking in IT training programmes and workshops that foster HS lecturers' technology integration into teaching, as well as the need for a repository to support them with sharable DM resources. The results from the acceptance study showed that PU ($\beta = 0.68$, $p<0.01$), COM ($\beta = 0.41$, $p<0.05$), and Com_Exp ($\beta = 0.15$, $p<0.01$), were the direct determinants of HS lecturers' IU of MRS for their lecture preparations. TS had a significant direct effect on COM ($\beta = 0.71$, $p<0.01$) and COM had a significant direct effect on the PU ($\beta = 0.43$, $p<0.01$). The proposed Web-SAM accounted for 59% of the variance explained on IU. When it was tested on Davis' original Technology Acceptance Model (TAM) with two determinants — PEU and PU — the variance explained of IU was only 45%. The greater proportion of the Web-SAM model proved that it is more robust than the original TAM. In the future, this study can be replicated in other fields and the proposed Web-SAM will be useful for evaluating the acceptance of other Web-based systems. MRS can be further enhanced to incorporate more features and functions to support the lecturers need.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Over the past two decades, technology innovations and the Internet/Web have been driving a rapid change in the teaching and learning experience (Sleeter & Tettegah, 2002). Educators slowly realized that traditional methods of teaching were no longer capable of providing students with an educational foundation that was strong enough to withstand the pressure of technology changes (Carter, 1999). According to Prensky (2001), the present generation are considered to be 'digital natives' who were born into the digital age (i.e. after 1980); they are more familiar with computers and the Internet than their predecessors — 'digital immigrants' who were born before 1980. He then stressed that the digital gap between two generations was the root cause of many educational problems. Digital immigrant lecturers were always a step behind in dealing with digitals in the classroom and they often failed the expectation of their digital native students who had grown up in the highly stimulating and interactive digital environment (Neo & Neo, 2004; Gaston, 2006).

A stimulating teaching and learning environment can be created by incorporating technology, especially multimedia technology, into the classroom (Carter, 1999; Neo & Neo, 2002). Today's broad range of electronic technology expands the multimedia tools available for teaching (Sleeter & Tettegah, 2002), which allow tutors or lecturers to prepare their lectures by using certain application software, such as Microsoft PowerPoint™ (Bouchlaghem et al, 1999). One can easily embed multimedia elements — often known as digital materials (DM) (images, audio and video files, and animations, etc) in the presentations.

There are several ways for lecturers to have access to DM for their teaching use. The possible means of getting DM for lecture preparations are as follows:

- creating their own DM by taking photographs with digital cameras or scanning the pictures from the textbook, taking videos or creating animated movies by using macromedia authoring tools such as Flash or Macromedia Director.
- borrowing some DM from the faculty's library such as audio or video CDs.
- retrieving from the e-learning system provided by the faculty (such as Learning Space or Moodle in Universiti Sains Malaysia).
- downloading from the digital repositories which provide freely accessible high quality DM such as HEAL and PubMed.
- sharing DM peer-to-peer via emails, messengers or by using some shareware such as Limewire and Bearshare.

Researchers worldwide also have called for exploring ways to enhance the teaching and learning environment with interactive multimedia teaching materials and methods usually not available in the traditional classroom or curriculum, including the medical and Health Sciences (HS) fields. These researchers have reported their trial development on a variety of multimedia educational tools (such as quizzes, training programmes and tutorials) for selected subjects, such as medical imaging, urology, anatomy, nutrition, speech therapy, to name a few. For example, in the United States (US), at the University of Houston, a group of researchers have developed an advanced cardiac life support (ACLS) training system for training medical personnel (Xie et al, 1999), and in the University of Minnesota, an online multimedia-based surgical training course was developed to teach trainees from the Surgery Department (Whitson et al, 2006). Similarly, a United Kingdom (UK) study conducted by Freeman et al (1996) reported their development of a multimedia tutorial for teaching speech therapy students from the University of Sheffield.

In parallel with those multimedia projects from the US and the UK, the National Taiwan University College of Medicine (NTUCM) started their first interactive group teaching using a computer network and multimedia techniques, including bulletin board systems (BBS), interactive case studies, virtual classrooms with video on demand (VOD), and Internet medical resources (Chen et al, 1998). Another Taiwanese study conducted by Tsai et al (2004) reported their work on the development of a computer-assisted multimedia training course for intravenous injection to train novice nurses. All these studies shared their positive experience from their pilot work and recommended multimedia integrated teaching (MIT) as a new pathway for teaching and learning environments.

1.2 Background of the Study

Although there is a significant body of research relating to MIT or Information and Communication Technologies (ICT) for medical and HS teaching in other countries, there is little information or research work that has been done in Malaysia in this regards. At medical and HS schools throughout Malaysia, a historical focus on lectures and memorizing is being replaced by new teaching methods such as case-based teaching (CBT), problem-based learning (PBL) and a variety of small group activities (Ismail, 2003). However, lecturers' ICT or multimedia integration in their teaching curriculum was still very limited owing to some limitations or barriers. This situation was highlighted by Ismail (2003) who addressed some individual barriers including: lack of academics' computer skills; lack of collaboration among the faculty members utilizing informatics; and difficulty in utilizing ICT components in everyday teaching and learning process. She suggested that retooling or retraining medical professionals is required in order to successfully integrate technology into the teaching curriculum. As a major step forward in changing their mindset, lecturers have to take advantage of interactivity and innovation provided by the multimedia components of the Internet and World Wide Web. To do so, the faculty also should plan ahead in providing a good network

infrastructure and ICT facilities, with ongoing training and technical support. She pointed out that in most of the Malaysian institutes, teaching comes second to research and development (R&D). A lack of institutional accountability for innovative teaching has contributed to the problem.

Wee and Zaitun (2006) also reported the same as academics from Malaysian institutes were encouraged to be actively involved in research activities and were rewarded based on their research publications. There were a few institutes with ICT vision, incentive systems and recognition for the lecturers who successfully integrated ICT into their teaching. Early researchers, for example (Johnston & McCormack, 1996), also identified those barriers as the organizational factors that influenced a lecturer's technology integration. There will be some lecturers who are innovative and interested in creating their own materials, while others might not have the skills to do so and might not have extra time beyond their research activities. They suggested that providing DM teaching resources could be a solution for those who have limited time and skills to create their own. Inglis et al (2002) also commented that an institution has to make a decision about the support mechanisms that should be associated with technology and resource materials. It is worthwhile raising the question about what are the possible ways for institutes to provide teaching DM to the lecturers, and what type of support mechanisms should be developed.

Meanwhile, a non-profit organization from the US also carried out a project on enhancing HS lecturers' multimedia usage that would help their daily practice of multimedia integration for teaching — i.e. developing a repository system for the HS lecturers (Candler, 1999). They developed a repository system namely, Health Education Asset Library (HEAL), which was established in 2000. An initial prototype collection of 2,500 items was made available in 2003. HEAL metadata Version 1 was formally released in April 2002, and has been modified

and updated from time to time. Since the HEAL metadata schema was designed to develop a repository system to deposit medical and HS multimedia materials, it is the most suitable metadata for other medical and HS institutions to adopt when developing a similar system. It enables HS academics to store and organize digital resources flexibly, and share them efficiently with their colleagues. It is not only a great opportunity for other HS institutions in the US but also for other countries like Malaysia. However, the sad fact was the negligence of Asian countries to grab the opportunity offered by HEAL. The lack of such a system in the Malaysian HS environment could be one of the organizational factors that impact on academics' technology integration into teaching. In addition, there could be some individual factors which also influenced their multimedia use.

A number of researchers have also undertaken a search for why academics do not appear to be integrating technology (e.g. multimedia or ICT tools) into teaching (Johnston & McCormack, 1996). Since computers became commonly used teaching tools in the 1990s, most of the studies conducted in the 1990s and early 2000s (e.g., Levin & Gordon, 1989; Cox et al; Murphy & Greenwood, 1998; Mukti, 2000; Hong & Koh, 2002), investigated academics' computer usage against other factors such as their computer experience, attitudes towards computers, demographic factors (such as their age and gender), and their perceived organizational support such as administrative and technical support.

When IT and Web technology had been infused into teaching and learning in the late 1990s, researchers' interest was moved to the 'Internet', 'IT' or 'ICT' rather than 'computers'. The researchers in later studies explored why academics were hampered by certain barriers in integrating technology into teaching. For example, an international study conducted in the US by Greensteina and Mckee (2004) investigated the lecturers' Internet use against their age. Likewise, an African study conducted by Oyelaran-Oyeyinka and Adeya (2004) explored the

different usage of the Internet between genders among academic staff, whilst Alghazo (2006) explored whether teachers' use of technology in the classroom was affected by their lack of advanced computer and Internet experience. Some researchers, such as Castillo (2005), Markauskaite (2005), Shaunessy (2007) and Usluel (2007), made their investigations on IT- or ICT-related factors such as academics' ICT capabilities and level of IT use. There were some local studies conducted in this respect. For example, Agboola (2006) looked into the 'preparedness of e-learning' among IIUM academic staff; Luan et al (2005) investigated UPM lecturers' use of computer applications and the Internet. Likewise, Wee and Zaitun (2006) also explored the obstacles faced by Information System (IS) lecturers on their ICT use.

Generalizing their report, academics' use of technology was affected by their age, gender and working experience, and also by their attitude towards technology and their technological experience and skills, as well as their organizational support in terms of teaching resources, technical support and training. When grouping those factors into similar perceptions, they can be grouped into four: demographic; attitudinal; experiential; and organizational factors. It was noted that those factors were studied a few at a time by those researchers. The effect of those factors on academics' technology use was not able to be seen properly if they were not included together in one study. More importantly, the comparison between those studies' findings could not be concluded holistically as a solution to the problems.

Without a proper investigation, it was impossible to comprehend the actual status of lecture preparations among Malaysian HS lecturers and the impact of using the technology. More importantly, it is essential for the organization's authority to know the possible ways for the lecturers to improve their technology-integrated teaching.

1.3 Problem Statement

The literature (Ismail, 2003; Greensteina & Mckee, 2004; Luan et al, 2005; Wee & Zaitun, 2006; Usluel; 2007) addressed several issues related to the barriers encountered in integrating ICT or multimedia in higher institutes, including medical and HS universities in Malaysia. Ismail (2003) stressed that there was a need for organizations to look into the current status of lecturers' ICT use in their teaching and provide them support where necessary. Early researchers had also explored and identified needs to overcome the barriers encountered by university lecturers in integrating IT into teaching. Based on their literature review on the surveys worldwide, Johnston and McCormack (1996) identified that some barriers were a result of insufficient organizational support for teaching resources, facilities, IT-related training programmes and technical support. The remaining barriers were due to individual factors such as academics' perceived attitude and knowledge of technology integration into their lecture preparation. Candler et al (2003), writing about the US HS lecturers, also addressed that a lack of a multimedia repository system (MRS) in the organization was a key factor in the lecturers' multimedia usage for teaching. Moreover, their lack of knowledge of digital rights and attitudes towards sharing were also obstacles to sharing multimedia materials among them.

Without clearly definitive data, their assumption could not be generalized for the Malaysian HS context. Studying a few factors at a time could not give the real solution to the problem. As early researchers failed to include all these factors in their studies, the current study will include all the possible factors (such as, age, gender, working experience, technological knowledge, awareness knowledge, attitude towards multimedia-integrated teaching, attitudes towards sharing DM and organizational support) which might influence HS lecturers' multimedia usage.

Considering all these factors together, the primary question is: Which combination of the factors best predicts HS lecturers' use of multimedia for lecture preparation? A second question also arises: What are the consequences and actions to be taken if MRS were a solution to support HS lecturers with DM materials?

1.4 Research Questions

The present study is aimed at exploring and investigating the HS lecturers ICT use in creating, or obtaining multimedia materials for their lecture preparation, and associated factors (either individual or organizational) influencing their usage in the classroom. The present study addresses the following research questions (RQ):

RQ 1: What is the current status of ICT usage for creating multimedia or DM for lecture preparation among HS lecturers from Malaysian public universities?

RQ 2: What are the HS lecturers' levels of multimedia practice, as well as their knowledge and attitudes towards multimedia-integrated teaching?

RQ 3: What are the levels of HS lecturers' perceptions of the organizational support in three areas: (1) teaching strategies; (2) teaching facilities; and (3) teaching materials?

RQ 4: Among the above, which area is the most important for improvement?

RQ 5: What are the difficulties encountered and the technical support requirements for HS lecturers in creating DM?

RQ 6: To what extent is HS lecturers' level of multimedia usage in teaching affected by other factors such as age, gender, knowledge, attitudes and perceived organizational support?

RQ 7: Are the training programmes or workshops conducted for HS lecturers adequate?

RQ 8: Are there any reliable Web-based repository systems available for HS lecturers in Malaysia?

RQ 9: Will the proposed Web-based System Acceptance Model (Web-SAM) be appropriate for the evaluation workshop?

1.5 Objectives of the Study

1.5.1 General Objectives

1. To explore the current status of multimedia usage among HS lecturers.
2. To conduct a situational assessment study to observe the current system of organization support for HS lecturers.
3. To design, implement and evaluate the acceptance of a new Multimedia Repository System (MRS).

1.5.2 Specific Objectives

1. To observe the current system of preparing lecture materials in Malaysian HS education by investigating their practice in the following domains:
    - Computer usage
    - Internet usage
    - Library usage
    - Hardware usage
    - Software usage
    - Practice of sharing DM among peers
    - Practice of existing repositories

2. To determine the following issues among HS lecturers in Malaysia:
    - attitudes towards sharing DM via the Internet
    - attitudes towards the multimedia integrated teaching
    - attitudes towards organization support in three areas: teaching strategies; teaching facilities; teaching materials
    - Perception on the importance of the copyright issues

3. To explore the difficulties and technical help requirement in creating DM for lecture preparation of Malaysian HS lecturers.

4. To determine the effect of knowledge, attitudes and other factors on the practice of multimedia for the lecture preparations.

5. To observe organizational support for technology-integrated teaching and determine the need of a MRS in the Malaysian HS teaching environment.

6. To implement a prototype of the MRS in accordance with the Health Educational Assets Library (HEAL) metadata schema version 2.1.

7. To design a suitable technology acceptance model to measure whether the proposed MRS meets the users' need, and the future use of MRS for lecture preparation.

8. To evaluate the new MRS by using the proposed Web-based System Acceptance Model (Web-SAM).

1.6 Action Plan of the Thesis Work

This study was planned to achieve the specific objectives outlined in section 1.5.2, within the expected time frame of three years. Table 1.1 shows the action plan and the main activities carried out in each phase of the study to achieve the specific objectives.

Table 1.1. Action plan of the study

Phase	Study	Activities	Specific Objective
Phase I	Exploratory Study (Jan 2005–Aug 2006)	- Reviewing literature on local & International IT/ICT in education - Conducting a nation-wide survey among HS lecturers from all 10 Malaysian Public Universities	Specific objectives 1 to 5
	Situational Assessment Study (Aug 2006–Feb 2007)	- Surveying USM IT/ICT-related training/workshop Modules for lecturers - Interviewing trainers/ facilitators from USM KK	Specific objective 5
Phase II	Design and Development of MRS (Jan 2006–Dec 2007)	- Adopting & adapting HEAL metadata schema - Collecting local DM (both individuals and departmental materials) - Protecting MRS resources with Creative Common (CC) copyright licences - Enabling HS lecturers to share building blocks of DMs for lecture preparation and lessons on course planning	Specific objective 6
	Acceptance Study (July 2007–Feb 2008)	- Conducting User Evaluation Workshop in the School of Health Sciences (PPSK), USM KK - Evaluating MRS (whether it meets HS lecturers' need and their Intention to use in future)	Specific objectives 7 & 8

Note: DM – Digital Materials; CC – Creative Commons; HS – Health Sciences

Phase I was carried out to achieve specific objectives 1 to 5. A nationwide survey was conducted among HS lecturers from ten Malaysian public universities and it was followed by the situational assessment study, using the Unversiti Sains Malaysia Health Campus (USM KK) as a case study. The latter study was conducted to validate specific objective 5 and also to underscore the current system of organizational support for HS lecturers in USM KK. For that study, the relevant training modules on IT-related training programmes and workshops were reviewed, and the facilitators or trainers of those programmes were also interviewed. In addition, observations were also made on the availability of an appropriate system for the HS lecturers to deposit and share their multimedia materials for their teaching preparation.

Results and findings from Phase I studies (both exploratory study and situational assessment study) led to the design and development of a Web-based repository system, namely the Multimedia Repository System (MRS), to fulfil specific objective 6. When the development of the MRS was complete, an evaluation workshop was conducted at the School of Health Sciences (PPSK) USM KK to determine the HS lecturers' acceptance of the MRS. This last activity was done to fulfil specific objectives 7 and 8.

1.7 Summary

A thorough literature search was done on digital databases such as ProQuest, Science Direct, Academic Search Elite of EBSCO and ERIC and the printed journals, to find out both local and international research regarding ICT/IT/Multimedia use among *university teachers* or *lecturers* in higher or tertiary education. All the Malaysian university websites were also browsed through to find out about unpublished and ongoing research focused on lecturers' practice (P) of those technologies for their lecturer preparation, and their knowledge (K) and attitudes (A) towards technology-integrated teaching and perceived organizational support

(POS) on 3 areas, i.e. teaching strategies, teaching facilities and teaching materials. It was instructive to note that these issues were definitely understudied and not yet properly documented in the HS teaching environment.

It was remarkable that very few local and international studies focused on the tertiary education level. Those studies targeted certain groups of academics on their use of technology (not specifically multimedia) such as 'literacy teachers' (Wepner, 2006), 'gifted teachers' (Shaunessy, 2007), 'academic staff in a post-secondary institution' (Agboola, 2006), 'IS lecturers' (Wee & Zaitun, 2006) and 'auditing professors and practitioners' (Greensteina & Mckee, 2004). Although they provided recommendations and conceptual facts for further studies in general, there is a paucity of research on 'HS environment regarding academics' use of multimedia'. For that purpose, this study targeted the Malaysian HS environment as the population of the study.

As mentioned earlier in section 1.2, a number of studies investigated academics' use of various ICT on different perspectives. For example, some researchers explored gender difference on ICT use (Luan et al, 2005) and Internet use (Oyelaran-Oyeyinka & Adeya, 2004), while others focused on the age issue of lecturers on Internet-related activities (Greensteina & Mckee, 2004). Some looked for the differences between gender on attitudinal factors, such as computer anxiety and attitudes towards computers (Hong & Koh, 2002), while some of them explored the effect of academics' knowledge or advanced experience with computers on academics' technology use in the classroom (Alghazo, 2006). Some studies investigated certain organizational factors such as training support (Shaunessy, 2007) and technical support (Kim et al, 2006). However, none of the above studies aimed to examine all these factors together in one study.

The current study aimed to investigate the effects of all these factors on Malaysian HS lecturers' practice of multimedia. Phase 1 of the study (exploratory study) not has only contributed to the documentation on HS lecturers' multimedia practice and other issues related to KAP and POS, but also tests the hypotheses in this regard, by using definitive data from the nationwide survey. Furthermore, an additional observation was made in USM KK (situational assessment study) to get a clear picture of the current status of organizational support for the HS lecturers' technology-integrated teaching. This information will be very useful for the HS organization authority to improve the teaching environment where it is necessary. The best practice framework introduced by this study also provides the organization with a useful benchmark to review, evaluate and improve the conditions and the planning processes.

Findings from the Phase I identified the factors associated with HS lecturers' multimedia practice and identified the needs to overcome the barriers encountered in the Malaysian HS environment — i.e. to develop a MRS that promotes HS lecturers' practice of multimedia integration. To fulfil the need, MRS was designed and developed in 2006, by the MRS team members with a grant provided by USM and a prototype was completed in November 2007. To ensure the acceptance of the target users (HS lecturers), MRS evaluation was conducted in January 2008, in PPSK USM.

A new acceptance model, namely Web-based System Acceptance Model (Web-SAM), was developed to test the MRS acceptance among HS lecturers. Web-SAM was adapted from two well-known models — Technology Acceptance Model (TAM), developed by Davis (1989) and Innovations Diffusion Theory (IDT), developed by Rogers. It consisted of Davis' two determinants — perceived ease of use (PEU) and perceived usefulness (PU) —, Rogers' one determinant compatibility (COM) and other three additional determinants — technical support (TS), Web experience (WE) and duration of computer experience (Com_Exp) in years. The

model introduced by this study accounted for 59% of the variance explained on intention to use (IU) MRS in the future. When it was tested on the original TAM with two Davis' determinants, PEU and PU, the variance explained of IU was only 45%. The larger proportion of variance of IU explained by the model proved that it is more robust than the original TAM. The results from that study have implied that the proposed model will be useful for other researchers in the related area.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

Searching the relevant research work related to the study interest, and reviewing the literature, is one of the most critical stages of conducting a thesis. A thorough search was made of the educational studies with regard to the use of technologies such as computers, the Internet and multimedia and the associated factors. Books, conference proceedings, theses or dissertations, online and printed journal articles, published between 1990 and 2007, and related to these areas, are reviewed and discussed in the separate sections of this chapter.

This chapter opens with a definition of the term 'multimedia' (section 2.2), followed by a brief description of digital rights and copyright licences (section 2.3) that protect the elements of multimedia or DM. The next section highlights the application of multimedia for teaching medical and HS subjects to enhance the teaching and learning environment in interactive ways (section 2.4). With the penetration of new technologies into education, educators or academics at all levels of education have to adapt themselves to be in the mainstream of a technology-savvy teaching environment. In the case of practising technology integration (e.g. computer, Internet, IT, multimedia, etc) in teaching, there are some factors, such as attitudes, knowledge, organizational support, age and gender, which affect the use of technology. Studies along this line in different settings (such as different background and education levels of the target population) were reviewed (section 2.5). Furthermore, some possible ways and suggestions to overcome these barriers, and the best practice frameworks in support of e-learning and new technologies for teaching, were also studied and reviewed (section 2.6).

A lack of a mechanism in the organization for sharing DM was one of the barriers for academics (Inglis et al, 2002) and providing them with a reliable multimedia repository system (MRS) could be a way or a possible solution to the problem of sharing the DM they created. As MRS development is part of the study, it is important to review the ideal characteristics of a typical MRS and the relevant metadata schemas (such as Dublin Core, HEAL, etc.) that are required for the system development (section 2.7). It is an essential task for the development team to investigate the acceptance of the system by the end users, and for that purpose 'technology acceptance models' have been reviewed and studied (section 2.8). Lastly, methodologies applied in other studies were reviewed before the decision was made upon the choice of methods and analyses for the present study. Criterion values used for those statistical analyses were also reviewed and discussed in the final section of this chapter (section 2.9).

2.2 Definition of Multimedia

Two decades ago, the word 'multimedia' still had a hyphen in it, i.e. 'multi-media' (Druin & Solomon, 1996). Since the word itself is too broad to fit into a proper definition, it is difficult to pin down a rigid definition of it. Generally, there are five elements of multimedia — text, images, audio, video and animations. According to Campbell (1994) and Havice (1999), 'multimedia' is nothing more than the combination of several media or methods of communication to present information. Feldman (1994) said that 'multimedia is a seamless integration of data, text, images of all kinds and sound within a single digital information environment.' Jameson (1998) defined 'multimedia' as 'visual, audio, and textual information which can be presented separately or simultaneously to convey and present information interactively to users.' According to Hofstetter (2001), multimedia is defined as 'the use of a computer to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate.'

Although different authors define multimedia in different ways, in the context of multimedia application in preparing lecture materials for teaching, it can be generally defined as: 'either a seamless integration of different media (such as text, images, animations, audio, and video files) or combination of more than one medium in an interactive way by using a computer.'

2.3 Protecting Multimedia Elements with Copyright Laws

The *information superhighway* (often referred to as *digital communication systems*) and advanced Internet technologies have made it possible for information seekers to surf through online digital resources in a matter of seconds. Nevertheless, information that is accessed on the Internet is subject to copyright laws just as printed sources are (Pedley, 2000). Generally, works that are protected by copyright are: books, scripts, websites, lesson plans, blogs and any other form of writing; photographs and other visual images; film, video games and other visual material; musical compositions, sound recordings and other audio works (Creative Commons, 2007). Aschenbrenner and Kaiser (2005) claimed that it should not be inhibited to the use that was made according to the fair dealing clause. According to the Copyright, Designs and Patents Act (CDPA) 1988, 'fair use' or 'fair practice' is stated as:

> 'fair dealing with a literary work, other than a database, or dramatic, musical or artistic work for the purposes of the study, does not infringe any copyright in the work or in the case of a published edition, in the typographical arrangement.'

'Fair dealing' can be applied for three specific purposes: for research or private study; criticism or review; and in reporting current events. One should bear in mind that copying or using someone's work for commercial purposes cannot be considered as 'fair dealing' (Pedley, 2000). Every single piece of multimedia element (e.g. image or video) has its own credit for its

intellectual property and the creator of that element has a right to protect their creative work. For Web-based databases and repository systems with growing resources, these can cause chaos when using those deposited materials without proper rights management. In developing a repository system, it is crucial for an institution to understand the involvement of issues related to copyright, intellectual property and the authenticity of the deposited digital materials (Fernandez-Aballi, 2007). Nowadays, taking into account all these problems, repository systems such as Health Educational Asset Library (HEAL), uses Creative Commons License Framework (CCLF) in order to protect the digital materials. Creative Commons (CC) is a non-profit organization, which takes responsibility for the rights of the multimedia materials on the Internet with a flexible licence framework. Detailed information about CC licences can be viewed in Appendix A.

It is important for the contributors (who contribute materials to the repository system) in licensing the work, as well as the information seekers (who search and download the materials from the system) to understand clearly the copyright conditions on the use of the materials. Adhering to those rights is even more important. It will not only solve the dilemma on the use of intellectual property but also reduce the infringements. It is good practice to read the copyright description, which mentions the conditions of use for the material. One can always contact the copyright holders to request any additional uses and clear any doubts on the copyright statements before making the commitment (Pedley, 2000).